Task 1.1: Understanding A/B testing framework report

Which online users belong to the control and exposed groups?

Control: 4071 users who have been shown a dummy ad belong to the control group

Exposed: 4006 users who have been shown a creative (ad) that was designed by SmartAd for the client belong to exposed group

How are the users targeted?

By being randomly shown different versions of an ad, the dummy ad and creative ad. They are then asked about whether they know the brand to determine which group is more aware of the brand
The BIO data for this project is a "Yes" and "No" response of online users to the following question

> *Q: Do you know the brand Lux?*
> > ➢ *Yes*
> > ➢ *No*

Could we use the counts of yes and no answers to make a judgement on which experiment is performing better? For example, if #yes > #no for the exposed group than the control group, could we declare that the ad had a significant impact Why or why not?

It's not a good idea to use counts to jump to the experiment judgment because you might have unequal number of users from each group, different factors that led to the decisions made by users. example like you might find that all users who used one kind of device, all have decided the same answer or hours have been affecting the users' responses and end up with a wrong decision. the best way to come up with good results is to use a Hypothesis testing in order to have a statistical significant difference and try to avoid type I and type II errors. type-

What is the statistical process that generates the data? Which kind of statistical model will you use if you were to simulate the data?

As the data collection was based on a YES or NO answers to the question of knowing the brand Lux, the statistical process that generated the data questioner as a binomial distribution. The statistical model to use in simulating the data is Bernoulli distribution
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Assessment of the statistical significance of an A/B test is dependent on what kind of probability distribution the experimental data follows. Given your answer above, which statistical tests (z-test, t-test, etc.) are appropriate to use for this project?

The appropriate statistical test to be used on our data case is Z test

In classical (frequentist) A/B testing, we use p-values to measure the significance of the experimental feature (being exposed to an ad in our case) over the null hypothesis (the hypothesis that there is no difference in brand awareness between the exposed and control groups in the current case). How are p-values computed? What information do p-values provide? What are the type-I and type-II errors you may have in the analysis? Can you comment on which error types p-values are related?

How are p-values computed?

P_ values are computed by computing the area under the curve of distribution or The p-value is the probability of finding the observed, or more extreme, results when the null hypothesis (H_0) of a study question is true

What information do p-values provide?

P-value is created to show you the exact probability that the outcome of your A/B test is a result of chance.

And based on that, statistical significance will show you the exact probability that you can repeat the result of your A/B test after. And low p-value leads to rejection of the null hypothesis

What are the Type-I and type-II errors you may have in the analysis?

Type-l Error-You reject the null hypothesis when it is true, that is, conclude that there is a difference in brand
Type-ll error-You fail to reject the null hypothesis when it is false, that is, and conclude that there is no difference in brand awareness between the two groups when there is difference

Can you comment on which error types p-values are related?
Type-l Error

How does the classical A/B testing (using z-test, f-test, etc.) framework work?

Classic A/B testing checks test results only at the very end when the sample size for both variation is reached

How does sequential A/B testing work?

Sequential A/B testing allows multiple checks on every step ensuring that error level won't exceed 5%

What are some of the advantages of sequential A/B testing?
It gives users a chance to finish experiment earlier without increasing the possibility of false results
It reduces the probability of errors arising from early stopping in the classical A/B test

How is A/B testing done using machine learning?

It is done by applying more complex factors into the model to model more complex and dynamic scenarios. A model is applied to the dataset and the predictions of the model are compared with a test dataset to determine how well the model predicts the response variable.
The model can also show which features are contributing significantly to the results.

What is the core idea behind this approach? In other words, what part of the machine learning analysis provides the insight regarding the high or no significance of the experimental feature?

The p-values show which features are important to the experiment and the predictive power

What are the pros and cons of using Machine learning to perform A/B testing?
    pros
    It can be used to interpret complex systems
    It can show the direction and magnitude of the experiment
    We can combine multiple approaches to gain insights
    Cons
    Some of the models used are difficult to explain
Machine learning models are prone to overfitting and false positives which can provide erroneous results and wrong interpretation of the test

In max three statements, make a problem formulation for machine learning and specify the target variable
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Let us take an example in agriculture, farmers want to see the change in production from the use of fertilizers and randomly some of the farmers were given the fertilizers to use in their lands and others kept their local ways of farming. The problem here is finding out which way gives the best production
The targeted variable is the amount of production